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THE RELATION OF PALEONTOLOGY TO THE HISTORY
OF MAN, WITH PARTICULAR REFERENCE TO
THE AMERICAN PROBLEM

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CONSIDERED in its broadest aspect, the most important relation of paleontology to the study of man concerns the support which it gives to the general theory of evolution of the organic world. If it be held that we have reason to believe man, with all his highest qualities, a product of evolution out of so-called lower animal types, then it becomes necessary to have a full knowledge of the history of man and of the forms preceding him, in order to understand the origin and the true nature of man's fundamental characteristics as they exist to-day. On the other hand, if there is reason to believe that man as

represented in his highest attributes is entirely apart from nature, the importance of paleontology, as offering a part of the explanation of the fundamental characteristics of man, is very greatly diminished. The value of paleontology would then lie largely in an interpretation of the setting or environment in which man is developing.

With these considerations in mind, it appears of the greatest importance for us to obtain as full a history of the organic world, and as satisfactory an interpretation of the processes therein concerned, as it is possible to secure. Particularly is it desirable to have before us a clear statement of that portion of the paleontological record which leads from the higher vertebrates through the primate division to man.

One of the important phases of general paleontological work which must receive special attention is the early history of the primate order with particular reference to the development of those characteristics which are most prominent in the human family. We have, as yet, accumulated too little evidence in this field. Among the characters which must be followed would be (1) extraordinary brain development, (2) the tendency to development of an upright position, (3) the freeing of the anterior limbs from the work of locomotion and the development in them of extraordinary adaptability. Whatever other interests one may have, there is certainly no more alluring problem than tracing from the primitive mammalia into the early primate those peculiar characters through which later on primitive man began the process of making nature subservient to himself. We may never know whether the brain actually grew large first and requisitioned the hands, so that the animal became bipedal and therefore finally erect in position, or whether a tendency to erect position was directed by the frequent assuming of a vertical position in a tree-climbing ancestor; but it is not beyond reason to presume that a thoroughly satisfactory paleontological record might give us an explanation of the origin of these characters.

The later primate history, or that which leads directly to the human type, is also unfortunately incomplete, though most remarkable advances have been made in the last few years. More missing links have already been furnished than science was supposed to require a few decades ago, but we can hardly be said to have one tenth of the material that it is desirable to have in order to show the transition from anthropoid to human, or from pithecanthropoid to the type of Spy or Neanderthal. European paleontologists are at the present time making rapid strides in filling the gaps of that portion of our ancestral chain which falls in the Quaternary system, and we may look for other important discoveries within the next decade.

It is to be presumed that the greater part of the work on the late Tertiary and Quaternary history of man will be carried on in the old world. The writer sees no reason why in this important work Amer-

ican paleontologists should not interest themselves to some extent in investigations now in progress in Europe and Asia, just as American archeologists have contributed to the success of work on the later history of man. Whether American paleontologists, working in their own field, are to have a part in interpreting the Pleistocene history of man is a burning question at the present time.

Whether we find that man was in North America in Pleistocene time or not, it is certainly true that one of the most important problems in the general history of the human race concerns the date of occupation of the western hemisphere by the human family. Discussion of the numerous finds reported to represent Pleistocene man in North America are too well known to every one to require particular mention. It should only be noted in passing, that as yet no specimens representing either skeletal remains or implements of man found in North America are generally recognized by geologists and paleontologists as of Pleistocene age. A careful search through the literature, and the investigation of many of the actual occurrences, lead the writer to the conclusion that we have, as yet, nothing in North America which can be considered as unquestionably representing Pleistocene man.

Also in South America there has been serious discussion of many interesting finds. The evidence on the whole seems to be more distinctly in favor of Pleistocene occupation there than is the case in North America. The discoveries made in recent years in the cave at Last Hope Inlet, and the numerous remains found in the Pampean formation at levels very far below the surface, seem difficult to interpret excepting on the supposition that man was present in South America before the beginning of the recent epoch.

It is to be presumed that any occupation of South America would necessarily be through migration by way of the northern continent, and proof of the presence of man in South America in Pleistocene time would be tantamount to proof that he was in North America at least as early. This suggestion does not, of course, take into account the theories of Ameghino to the effect that man is possibly derived from some of the South American monkey forms. Another suggestion made by Ameghino would give us an immigration of old world forms, possibly with ancestral man, coming into the southern continent in comparatively late time, by some other route than North America.

In the consideration of man's history in America, it is particularly important to notice the probable relation of migrations of the human family to migrations of other groups of mammals. The presumption is that the migrations of primitive man were caused or occasioned largely by influences of the same sort as have produced the spreading out or migration of many other mammalian types. It becomes then particularly necessary to discover exactly when the more recent migra-

tions of mammals into the North American continent have taken place, and, so far as possible, the exact routes of migration. This problem is in a large part paleontological, requiring for its interpretation a satisfactory account of the paleontology of vertebrates, invertebrates and plants of North America and of Asia, with particular reference to the relations of adjacent areas. We must also have, associated with this information, a full statement of the crustal movements in these regions as interpreted by the stratigraphic geologists and the physiographers.

Through the accumulated efforts of paleontologists in this country particularly, we have already a considerable mass of evidence bearing on the general relationships of the faunas of North America and Asia in comparatively recent geological time, but the detail of the problem is, as yet, scarcely indicated. Particularly for Pleistocene and Pliocene time our knowledge of the faunal succession is exceedingly meager, and we can scarcely expect to know anything satisfactorily until the Pleistocene mammalian paleontology of America has been worked out in detail. This work must be followed or accompanied by similar studies of the mammalian faunas of western and southern Asia. When this is completed we shall know the time of the various migratory movements, the nature of the faunas which migrated, the character of the land areas over which they have passed, and the climatic conditions which obtained along the routes of migration. The presumption is, that when this is done we shall have actual evidence of the time of man's occupation of North America.

Viewed in the large, and without regard to the detail which has just been indicated, it seems possible to present several reasonable conclusions with reference to the probable period of migration of man to America. It is shown by study of a map of linguistic stocks of the western hemisphere that the northern and southern continents taken together may be divided into between one hundred and two hundred provinces, based on the number of stocks represented. These languages vary greatly in their structure, and are not similar to the languages of other parts of the world. There is every reason to believe that a large percentage of them have been developed by linguistic differentiation which occurred since man first occupied this continent, and that measured in years the time required for this differentiation has been long. On the other hand, considering the American continent as a whole, we find that the greatly differing physical environments are not reflected to any extent in different physical types of people occupying this region. That the human family is not exempt from physical differentiation, such as is almost universally indicated in mammals which have for some time been distributed over large areas with varying environments, is clearly shown by the map of the old world. In that region the human race is known to have been spread over a wide

area for a long period, and we find several greatly differing human physical stocks in different geographic regions, just as we find differing stocks of mammals and birds.

With the lack of physical diversity among the people of the western hemisphere, there is also noticeable a resemblance of the whole group to the people of the adjacent region of Asia. Judged by the standards of differentiation which we obtain through a study of the history of geographical distribution of other mammalian groups, we have every reason to think that the people of America are immigrants who came from the Asiatic region and spread themselves over America after the period of the first great physical differentiation of the race, and so recently that a second stage of physical differentiation has not yet had time to develop. On the other hand, the time measured in years has been long enough so that linguistic differentiation could take place.

Inasmuch as a large part of human history falls within the Quaternary period, the question naturally arises as to whether the principal migrations of man to the American continent occurred *before, during* or *after* the Glacial epoch.

As primates are naturally animals of a warm or temperate zone, it is hardly to be presumed that primitive man came to America *during* the ice age, though there is a possibility of immigration in some of the interglacial epochs. Judging from what is suggested through study of physical differentiation, it appears improbable that man came over as early as the epoch preceding the ice age. In other groups of animals spread over large areas, marked physical differentiation has ordinarily taken place in a space of time comparable to the Glacial epoch. Had man been present in America during this long period, widely differing physical types would almost certainly have developed. On the whole it seems most probable that he arrived after the end of the last division of glacial time, or very near the beginning of the present epoch. Whether his arrival is shown to have occurred just before or just after the beginning of this epoch remains to be determined.

In conclusion it seems desirable to call the attention of paleontologists once more to the important part which their work must play in obtaining the information which we need with reference to the history of man and his antecedents. Only a small beginning has been made, and the results which must come are of great importance in the large problem of man's relation to nature. It is necessary that paleontologists keep the subject before them, in order to make certain that all information bearing upon it may be recognized as it becomes available, and be given its proper place in relation to other evidence now at hand.

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